AN - 1994-337190 [42]

TI - Series compensator for electrical power system - includes electrostatic capacitor connected in parallel with the other components, to increase reluctance of system

AB - J06261456 The series compensator has a reactor (3) in series with a semiconductor switch (2). To both the ends are connected a capacitor (1), an overvoltage protection device (4) and a bypass switch (5) in parallel. These components are sealed in a receptacle (6) filled with an insulating medium. The compensator is placed underground.

- ADVANTAGE - Increases stability of system. Raises compensating ratio. Improves safety and reliability. Increases transmission capacity.
- (Dwg.1/12)

IW - SERIES COMPENSATE ELECTRIC POWER SYSTEM ELECTROSTATIC CAPACITOR CONNECT PARALLEL COMPONENT INCREASE RELUCTANCE SYSTEM

PN - JP3315181B2 B2 20020819 DW200261 H02J3/18 006pp
- JP6261456 A 19940916 DW199442 H02J3/18 007pp

IC - H02J3/18 ;H02J3/20

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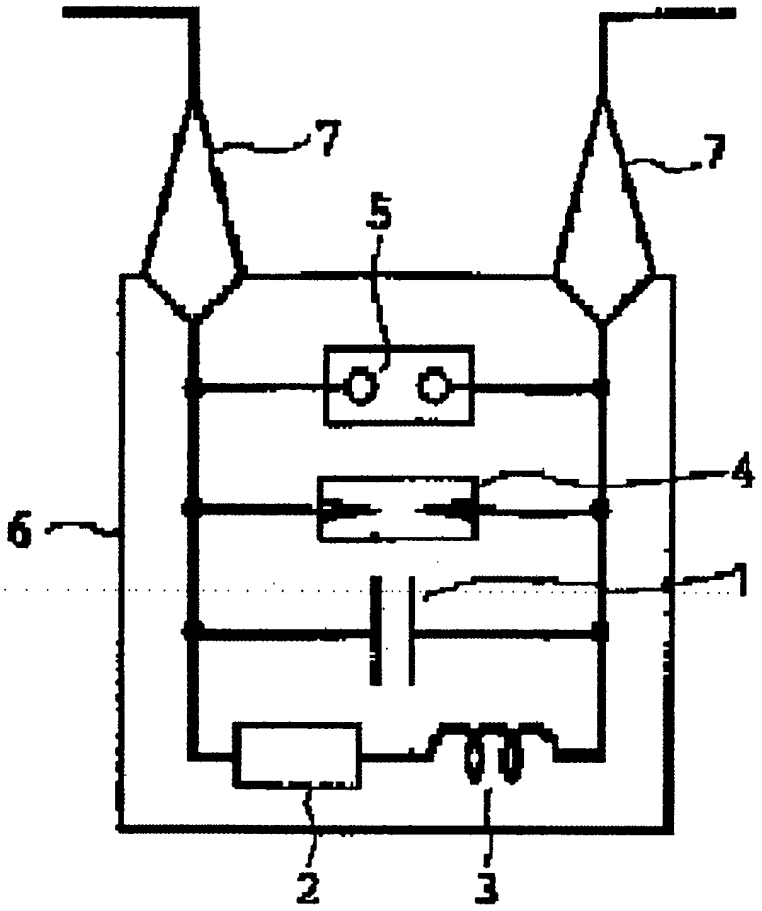
PA - (HITA ) HITACHI LTD

AP - JP19930043805 19930304; [Previous Publ. JP6261456 ]

PR - JP19930043805 19930304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* NOTICES *



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DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the series compensation equipment which inserts a capacitor in a serial at least at electric power system, in order to compensate the reactance of electric power system.
[0002]
[Description of the Prior Art] Generally, the reactance of a network is known as one of the factors which determines power system stability and transmission capacity. If the reactance of a network is large when transmitting a certain fixed power, it will be necessary to enlarge the phase angle between the generators which are in every place of a network compared with the case where a reactance is small, and the stability of a network will fall according to increase of this phase angle. Moreover, when the power transmission power P decided by static stability sets [ the reactance of a network ] the phase angle of V1 and V2, and network both ends to delta for the electrical potential difference of XL and network both ends, it is expressed with several 1 formula, and if the reactance of a network is large, the power transmission power P will be restricted.
[0003]
[Equation 1] P=V1xV2xsin delta/XL -- a capacitor is inserted in a network and a serial, the stability of a network is improved in order to compensate the 34th volume No. 5 202 pages of electric joint research for the reactance of a network like a publication there, and the approach to which transmission capacity is made to increase is proposed.
[0004]
[Problem(s) to be Solved by the Invention] However, the degree which compensates the reactance of a network with the conventional series compensation equipment mentioned above, i.e., a compensating ratio, is immobilization, and only selection of whether the whole equipment is inserted in a network using a mechanical switch mechanism or to separate the whole equipment from a network can be performed, but optimization of traffic progressive control is difficult. On the other hand, although the circuitry which connects the series connection object of a solid state switch and a reactor to a capacitor and juxtaposition is considered, in any case, series compensation equipment is a mind abortion marginal method, and there is a problem in respect of safety and dependability that it is easy to be influenced of a surrounding environment. If it is necessary to support with insulating support, such as an insulator, in the above height from which the insulation of a network electrical potential difference can secure the whole equipment to the earth and the weight of the whole equipment becomes dozens of t or more with the network electrical potential difference when a mind abortion marginal method is moreover adopted, it will become difficult to secure and support sufficient earthquake-proof reinforcement.
[0005] The purpose of this invention is easy the insulation to the earth, and it is to offer the series compensation equipment which raised the stability of traffic progressive control.
[0006]
[Means for Solving the Problem] It is characterized by having connected the solid state switch and

reactor which carried out [redacted]eries connection to the above-mentione[redacted]pacitor at electric juxtaposition in the series compensation equipment with which the reactance of electric power system is compensated in order that this invention may attain the above-mentioned purpose, and which inserted the capacitor in the serial at electric power system, and containing the above-mentioned capacitor at least in the well-closed container into which the insulating medium was put at least.

[0007]

[Function] by carry out closing motion control of the solid state switch connected to a capacitor and electric juxtaposition like **** , since the series compensation equipment by this invention do not expose live part while make the insulation to the earth easy by contain in the well-closed container which could change the compensating ratio of the reactance of electric power system , and could consider as the optimal compensating ratio according to the tidal current condition of a network desirably , and be filled up with the insulating medium , it can attain improvement and a miniaturization of dependability .

[0008]

[Example] A drawing explains the example of this invention below.

[0009] Drawing 1 is the outline block diagram showing the series compensation equipment by one example of this invention.

[0010] The series compensation equipment which connected both ends to the network by the bushing 7 of a pair at the serial The capacitor 1 inserted in a serial at a network in order to be constituted in the common well-closed container 6 and to compensate the reactance of the transmission line, The overvoltage protection equipment 4 connected to juxtaposition in order to protect this capacitor 1 from an overvoltage, It has the bypass switch 5 which is connected to juxtaposition and connects the both ends of a capacitor 1 with a capacitor 1 too hastily, the solid state switch 2 which is constituted using a semiconductor device and can perform alternating current control while connecting with a capacitor 1 at juxtaposition, and the series connection object of a reactor 3. Overvoltage protection equipment 4 changes by a nonlinear device, a discharging gap, etc. like a zinc oxide component, and constitutes a bypass switch 5 from a mechanical switch, a solid state switch, etc. Moreover, the solid state switch 2 is constituted by semiconductor devices for switching, such as a thyristor, a light-spot arc type thyristor, and a gate turn-off thyristor, the snubber circuit of those which is not illustrated, and the overvoltage overcurrent-protection component. It fills up with insulating media, such as non-conductive gases, such as 6 sulfur-fluoride gas, dry air, nitrogen gas, insulating oil, and nonflammable liquid, and a liquid, in the well-closed container 6 which contained each [ these ] component, this well-closed container 6 is manufactured and grounded by the conductive member, and each component of that interior is supported in the condition of having insulated from the well-closed container 6 electrically by the insulating member which omitted illustration. The insulating medium in a well-closed container 6 not only raises the insulating strength between each internal component and a well-closed container 6, but it uses it as a cooling medium for controlling positively generation of heat by energization of a current like especially the solid state switch 2.

[0011] According to the series compensation equipment of a configuration of having mentioned above, by closing a bypass switch 5 and short-circuiting the both ends of a capacitor 1, a bypass switch 5 can be opened, and a capacitor 1 cannot be inserted in a network, or it cannot come out [ **** / removing a capacitor 1 from a network ] as much as possible, and the compensating ratio by the switching control of a solid state switch 2 can be controlled. And since repetition actuation at a high speed is easily possible for a solid state switch 2, fine control which will be in the optimal tidal-current condition to the tidal current which changes every moment is attained. Since the solid state switch 2 is moreover also collectively contained in a well-closed container 6, If the method which can use as a cooling medium for controlling positively generation of heat according the insulating medium with which the interior was filled up to energization of a current like a solid state switch 2, and circulates through an insulating medium by the convection current by heat is adopted It becomes unnecessary to form a pump, a cooling fan, etc. for circulating an insulating medium outside, and safety and dependability can be improved further.

[0012] Drawing 2 is the o[redacted]e block diagram of the series compensa[redacted]equipment by other examples of this invention, it attaches a non-[ same ] sign to an equivalent with drawing 1 , omits explanation, and explains only the different part.
[0013] Although the both ends of a capacitor 1 are short-circuited and will be in the condition of not carrying out series compensation if it carries out close [ of the bypass switch 5 ] in the configuration of drawing 1 , series compensation equipment is not necessarily separated from a network. Therefore, power transmission must be stopped when carrying out the maintenance check of the solid state switch 2 grade. Then, the capacitor 1 grade is connected [ into a well-closed container 6 ] through an open/close switch 8 like drawing 2 R> 2, respectively to the both ends of a bypass switch 5.
[0014] If close [ of such circuitry, then a bypass switch 5 ] is carried out, a capacitor 1 is bypassed and the double door close switch 8 is opened, it will dissociate from a network and the part which needs maintenance check of solid state switch 2 grade can work safely by grounding the said division after that.
[0015] Drawing 3 shows the outline block diagram of the series compensation equipment by other examples of this invention, and in order to take each component of the series compensation equipment contained in the well-closed container 6 in and out, it forms in a well-closed container 6 two or more closing motion regio oralis 9 made airtight connection of the disconnection of possible.
[0016] Although each closing motion regio oralis 9 is airtightly closed by sealing means, such as a lid, in the steady state, it opens wide at the time of anchoring of each component or maintenance check, and carrying-in taking out and the various activities of each component are done from here. In addition, each [ these ] closing motion regio oralis 9 corresponds for every component, and it may form in dedication, or it may be shared and formed for two or more components of every.
[0017] Drawing 4 shows the outline block diagram of the series compensation equipment by the example of further others of this invention.
[0018] Although circuitry is the same as that of the example shown in drawing 1 , in the configuration of the well-closed container which contains each component, it is different. That is, the well-closed containers 6a, 6b, 6c, and 6d which correspond for every component were formed, the bypass switch 5 was contained in well-closed container 6a, overvoltage protection equipment 4 was contained in well-closed container 6b, the capacitor 1 was contained in well-closed container 6c, and the solid state switch 2 and the reactor 3 are further contained in 6d of well-closed containers. The conductor which connects between each [ these ] component electrically forms one well-closed container 6 as the interference sections 10a and 10b formed in each well-closed containers 6a, 6b, 6c, and 6d, respectively, and the whole which opened for each well-closed containers 6a, 6b, and 6c and 6d for free passage for the inside of 10c by through and each [ these ] interference sections 10a, 10b, and 10c.
[0019] According to such a configuration, each well-closed containers 6a, 6b, 6c, and 6d can be formed in the magnitude according to the component contained to the interior, respectively, and can constitute the single well-closed container 6 which was mutually open for free passage by establishing after that a means to hold and connect an airtight like a flange with each interference sections 10a, 10b, and 10c. Therefore, a connection means like a flange can also separate and convey and not only manufacture of well-closed containers 6a, 6b, 6c, and 6d but conveyance etc. becomes easy. Furthermore by drawing 4 , each well-closed containers 6a, 6b, and 6c and the configuration against which each well-closed containers 6a, 6b, 6c, and 6d can be arranged to the same horizontal plane, or can be accumulated on a bilayer, and can also be connected with after that, and the accommodation of installation is effective although it has arranged so that 6d may be accumulated perpendicularly, and between each was connected can be taken.
[0020] As opposed to having contained the solid state switch 2 and the reactor 3 in 6d of well-closed containers in both the examples that drawing 5 shows the outline block diagram of the series compensation equipment by the example of further others of this invention, and were shown in drawing 4 While the well-closed containers 6e and 6f of the pair of a vertical mold are arranged face to face in the lower part of well-closed container 6c which contained the capacitor 1, and arranging a solid state switch 2 in well-closed container 6e and arranging a reactor 3 in 6f of well-closed containers It has

connected by these well-c[redacted]d container 6e and interference section [redacted]which has a means to hold an airtight like a joint and to connect for 6f. Other configurations are the same as that of the example shown in drawing 4 , and the same effectiveness as an example is previously acquired also by such configuration.

[0021] Drawing 6 shows the outline block diagram of the series compensation equipment by the example of further others of this invention, and divides and contains the capacitor 1 which becomes comparatively large to having contained the capacitor 1 altogether in well-closed container 6c in the example shown in drawing 4 . That is, the well-closed container 6c1 connected with shaft orientations by 10f of interference sections which have a means to hold and connect an airtight like a joint in well-closed container 6b and 6d and 6c2, While arranging the well-closed container 6c3 connected with shaft orientations by 10g of interference sections which have a means to hold and connect an airtight like a joint, and 6c4 The capacitors 1a, 1b, 1c, and 1d which connected between a well-closed container 6c1 and 6c3 and between 6c2 and 6c4 by 10d of interference sections, respectively, divided them in each [ these ] well-closed container 6c1, 6c2, 6c3, and 6c4, and were constituted are distributed. Other configurations are the same as that of the example shown in drawing 4 . Although it divides and does not restrict constituting to a capacitor 1, especially in series compensation equipment, the volume of a capacitor 1 becomes large as compared with other components in many cases, and even if it does not manufacture a big well-closed container specially by dividing the whole capacitor into some like drawing 6 , and containing to a well-closed container, use of a standard well-closed container is attained.

[0022] Drawing 7 is the side elevation showing the outline block diagram of the series compensation equipment by the example of further others of this invention, and juxtaposes each well-closed containers 6a, 6b, 6c, and 6d shown in drawing 4 mentioned above almost respectively in parallel on an installation side. If each well-closed containers 6a, 6b, 6c, and 6d are horizontally arranged when an installation is comparatively large, it can be made low, and it is stabilized, the height of equipment can be installed, and earthquake resistance can be improved. However, since an installation generally has a limit, as shown in drawing 8 , it is good, while arranging 6d horizontally each well-closed containers 6a, 6b, and 6c and to accumulate several steps and to arrange. However, it is good to arrange the well-closed container of the component with which weight becomes heavy at this time, and a component with the need of performing maintenance check comparatively frequently, near the installation side.

[0023] Although the bushing 7 of a pair was established to the well-closed container 6 as shown in drawing 1 , and it connected with the network through this bushing 7, the series compensation equipment mentioned above may be built into the ****** facility which consisted of not only when installed independently, but gas insulated switchgears, and may be constituted. In such a case, if the connections 11a and 11b which connect the well-closed containers 20a and 20b of the gas insulated switchgear of the ****** facility instead of the object for bushing attachment with the well-closed container 6 of series compensation equipment directly are constituted as shown in drawing 9 , it can consider as the ****** facility including series compensation equipment of one. For example, the bushing 22 prepared in the end of a gas insulated switchgear can be connected to the transmission line 21 like the substation which wrote together the circuit diagram to drawing 10 , and a transformer 27 can be connected and constituted through a gas circuit breaker 26 in the other end of the gas insulated switchgear which connects series compensation equipment 25 and changes between a gas circuit breaker 23 and the gas insulation bus-bar 24. Moreover, in the case of a middle switchyard which wrote together the circuit diagram to drawing 11 Bushing 22a prepared in the end of a gas insulated switchgear is connected to transmission-line 21a of a two-times line. Gas-circuit-breaker 23a and gas insulation bus-bar 24a, It connects with the other end of the gas insulated switchgear which connects series compensation equipment 25 common between gas-circuit-breaker 23b and gas insulation bus-bar 24b, and changes through bushing 22b at transmission-line 21b of a two-times line. It can constitute so that a part for the reactance of the transmission lines 21a and 21b of a two-times line may be compensated collectively. according to such a ****** facility -- series compensation equipment -- also setting -- live part -- since it can arrange in the well-closed container which made the conductor ground potential and

exposure outside can be l[redacted]afety increases and the dependability o[redacted]s insulated switchgear is not spoiled

[0024] Although it was open for free passage in gas and each constituted the interior of each well-closed container from each example shown in drawing 4 thru/or drawing 8 mentioned above, at least one well-closed container may be classified in gas, and may consist of other well-closed containers. For example, as shown in drawing 12 , while constituting the connection section which consists in the middle of each interference sections 10a, 10b, and 10c which connect each well-closed containers 6a, 6b, 6c, and 6d of a flange in the case of the example of drawing 4 R> 4 mentioned above The insulating spacers 28a, 28b, and 28c are made to be placed between these connection sections, and for each well-closed containers 6a, 6b, and 6c and 6d may be classified in gas, and may be constituted. An insulating medium desirable for the component which is arranged in each well-closed containers 6a, 6b, and 6c and 6d according to such a configuration, In well-closed container 6b which contained overvoltage protection equipment 4 again in well-closed container 6c which contained the capacitor 1, insulating oil for example, insulating gas Moreover, in 6d of well-closed containers which contained the series connection object of a solid state switch 2 and a reactor 3, it can be filled up with an insulating medium of a different kind like air, or filling pressure can also be changed also by the still more nearly same insulating medium.

[0025]

[Effect of the Invention] As explained above, since the series compensation equipment by this invention has arranged the series-connection object of a solid state switch and a reactor to the capacitor with which the reactance of electric power system is compensated at least in the well-closed container filled up with the insulating medium, and this and juxtaposition, while being able to make a compensating ratio adjustable by control of a solid state switch, a well-closed container can be grounded, safety and dependability can be raised, and the improvement in power system stability and the increment in transmission capacity are attained.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]
[Drawing 1] It is the outline block diagram of the series compensation equipment by one example of this invention.
[Drawing 2] It is the outline block diagram of the series compensation equipment by other examples of this invention.
[Drawing 3] It is the outline block diagram of the series compensation equipment by the example of further others of this invention.
[Drawing 4] It is the outline block diagram of the series compensation equipment by the example of further others of this invention.
[Drawing 5] It is the outline block diagram of the series compensation equipment by the example of further others of this invention.
[Drawing 6] It is the outline block diagram of the series compensation equipment by the example of further others of this invention.
[Drawing 7] It is the outline block diagram of the series compensation equipment by the example of further others of this invention.
[Drawing 8] It is the outline block diagram of the series compensation equipment by the example of further others of this invention.
[Drawing 9] It is the outline block diagram of the series compensation equipment by the example of further others of this invention.
[Drawing 10] It is the front view of a substation using the series compensation equipment of this invention.
[Drawing 11] It is the front view of a middle switchyard using the series compensation equipment of this invention.
[Drawing 12] It is the outline block diagram of the series compensation equipment by the example of further others of this invention.
[Description of Notations]
1 Capacitor
2 Solid State Switch
3 Reactor
4 Overvoltage Protection Equipment
5 Bypass Switch
6, 6a-6d Well-closed container
8 Open/close Switch
28a, 28b, 28c Insulating spacer

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* NOTICES *



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CLAIMS

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[Claim(s)]
[Claim 1] Series compensation equipment characterized by having connected the solid state switch and reactor which carried out the series connection to the above-mentioned capacitor at electric juxtaposition, and containing the above-mentioned capacitor at least in the well-closed container into which the insulating medium was put in the series compensation equipment with which the reactance of electric power system is compensated, and which inserted the capacitor in the serial at electric power system at least.
[Claim 2] Series compensation equipment characterized by containing the above-mentioned capacitor, the above-mentioned solid state switch, and the above-mentioned reactor in the common above-mentioned well-closed container in a thing according to claim 1.
[Claim 3] Series compensation equipment characterized by having contained the above-mentioned capacitor, and the above-mentioned solid state switch and the above-mentioned reactor in the thing according to claim 1 in the above-mentioned well-closed container which carried out the gas partition, respectively, and putting in an insulating medium in these above-mentioned well-closed container, respectively.
[Claim 4] Series compensation equipment characterized by having formed the bypass switch in juxtaposition electrically with the above-mentioned capacitor, and connecting an open/close switch with this bypass switch between the above-mentioned capacitors in a thing according to claim 1.

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DRAWINGS

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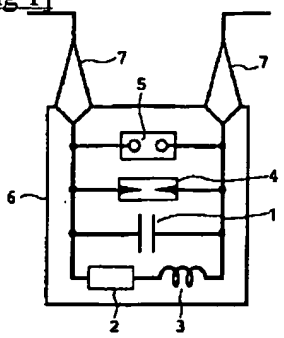
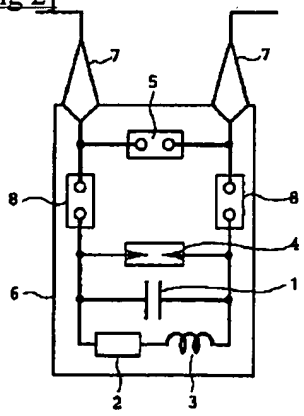
[Drawing 1]
【図1】

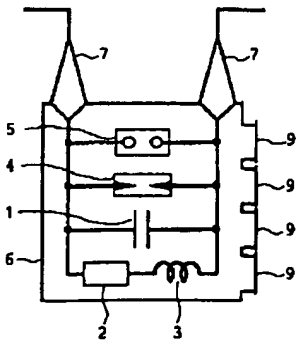



1：コンデンサ
2：半導体スイッチ
3：リアクトル
4：過電圧保護装置
5：開閉スイッチ
6：密閉容器

[Drawing 2]
【図2】

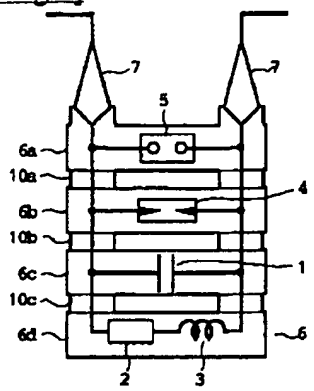



[Drawing 3]
【図3】



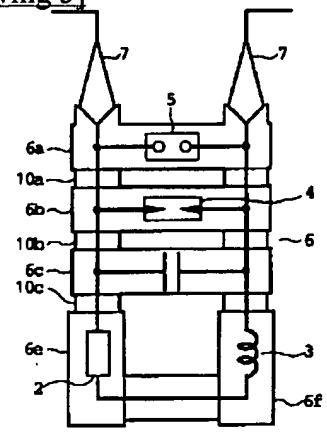
[Drawing 4]

【図4】



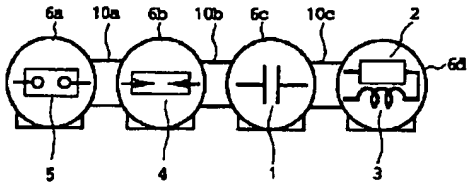

[Drawing 5]

【図5】



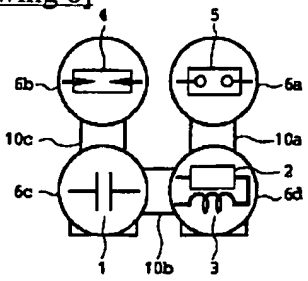

[Drawing 7]

【図7】



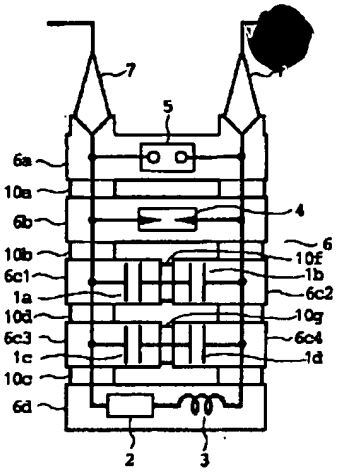

[Drawing 8]

【図8】



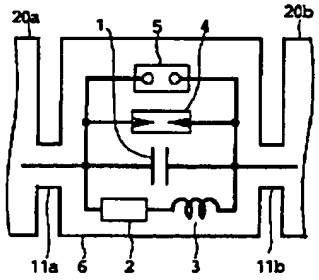

[Drawing 6]

【図6】



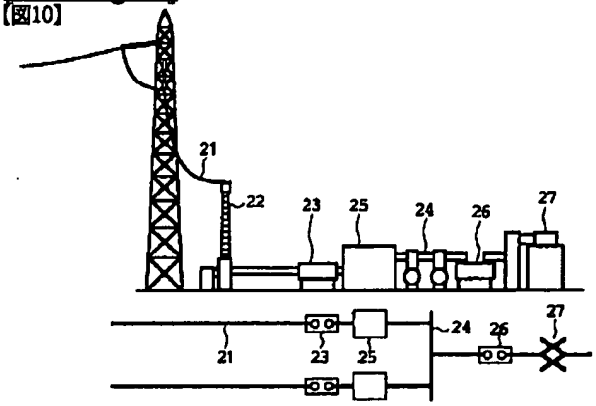

[Drawing 9]

【図9】



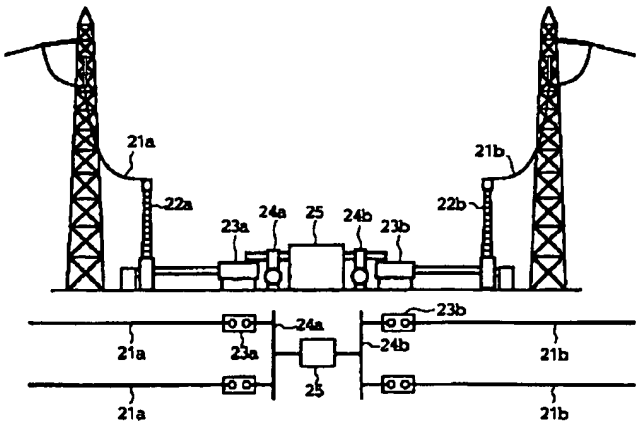

[Drawing 10]

【図10】

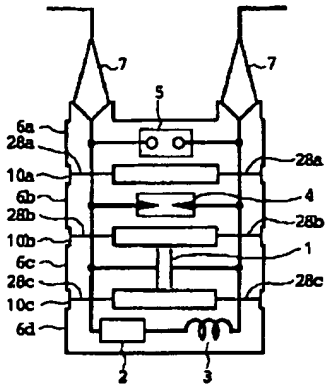



[Drawing 11]

【図11】



[Drawing 12]
[図12]

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